



Original Article

Evaluation of the Results of Closed Antegrade Interlocking Intramedullary Nail for Proximal and Mid Shaft Femur Fracture

Md Habibul Hasan,¹ Md Shah Alam,² Md Abul Kalam Azad,³ Md Ahsanuzzaman⁴

Abstract

Background: Fractures of the shaft of the femur are among the most common fractures encountered in orthopedic practice. Various treatment options are available but closed interlocking intramedullary nail for fracture shaft of the femur is the gold standard treatment.

Objectives: This randomized clinical trial was conducted to evaluate the results of closed intramedullary interlocking nailing for proximal and mid shaft femoral fractures in adult in our country.

Materials and Method: This study was conducted at the National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Sher-E-Bangla Nagar, Dhaka and private Hospital of Dhaka and Rajshahi over a period of four and half years (August 2013-August 2017). Adult patients with closed fracture of proximal and mid shaft of the femur were the study population. A total of 50 patients (50 femoral shaft fractures) aged 18-65 years irrespective of sex were included in the study. The mean age of the patients was 36.52 ± 15.24 . Majority of the patients were male. Twenty seven (54%) patients were operated on left side and twenty three (46%) patients were operated on right side. Average time interval between injury and date of surgery was 8.26 days and average time of operation was 95 minutes.

Results: 42 patients (84%) has found union within 20 weeks, 6 patients (12%) has found delayed union and was dynamized and united, 01(2%) patient has lost follow up and 01(2%) patient has died at home at 16th post-operative day. Full range of knee movements was found in all cases.

Conclusion: Closed locking intramedullary nailing for fracture proximal and mid shaft of the femur is a good option due to less infection, early healing and less scar formation, good range of knee and hip movement.

TAJ 2019; 32: No-2: 27-35

Introduction

Trauma is a growing global public health concern. It is a major cause of death and disability worldwide. Trauma disproportionately affects low and developing countries and accounts for more disability than tuberculosis, HIV (human immunodeficiency virus), malaria or cancer.¹

Trauma is also the leading cause of death globally among people between the ages of five and forty-five years.² Accidents involving motor vehicles are the main cause of nonfatal injuries, with musculoskeletal trauma accounting for the majority of these injuries. Femoral fractures are

¹ Junior consultant, Department of Orthopaedics, Rajshahi Medical College Hospital.

² Professor, Department of Orthopaedics, NITOR.

³ Junior Consultant, Department of Orthopaedics, Netrokona Sadar Hospital.

⁴ Assistant Registrar, Department of Orthopaedics, Rajshahi Medical College Hospital.

the most common musculoskeletal injury, accounting for 9% of all nonfatal injuries.³

Different treatment modalities can be used to treat fracture shaft of the femur. Intramedullary interlocking nailing is the gold standard. Intramedullary nails are weight sharing implants which allow immediate weight bearing after stable fixation.⁴

In most least developed countries, skeletal traction is still the mainstay of treatment for femoral shaft fractures and is often accompanied by the known complications of pin-track infection, malunion, nonunion, thromboembolic disease, and decubitus ulcers.⁵ In 1968, Kuntscher to meet the emergent situation practised closed intramedullary nailing with good results.⁶

Treatment options like surgical stabilization using intramedullary devices, external fixator or plating with screws but all have results inferior to intramedullary interlocking nails.⁷

Closed intramedullary nailing has become standard of treatment for femoral shaft fractures.⁸ Closed intramedullary Interlocking nailing allows early mobilization with minimal scarring of thigh musculature, results in early functional recovery with lesser complication rates, as fractures site is not open, the chances of union are greatly increased.

In 1940, Küntscher stated that closed intramedullary nailing of the femur offer an ideal anatomical, functional, and physiological treatment for fresh femoral fractures. Intramedullary (IM) nailing is an effective method of treating femoral shaft fracture and has become one of the preferred procedures in orthopedics. Intramedullary fixation of femoral shaft fractures allows early mobilization of the patient (within 24–48 h if the fixation is stable), improved knee and hip range of motion and a marked decrease in

the cost of hospitalization. Intramedullary nails are load-sharing devices, allowing the bone to transmit compressive forces while maintaining axial alignment.⁹

Materials and Methods

This study was conducted at the National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Sher-E-Bangla Nagar, Dhaka and private Hospital of Dhaka and Rajshahi over a period of four and half years (August 2013-August 2017). Study design was quasi experimental study and purposive sampling technique was followed. Adult patients with closed fracture of proximal and mid shaft of the femur were the study population. Exclusion criteria Patients below the age of 18 years & above 65 years, Open fracture, Pathological fracture, Fracture of the distal third and Supracondylar fracture of the femur, Deformity of the femur (Previously malunited fracture).

A total of 50 patients (50 femoral shaft fractures) aged 18-65 years irrespective of sex were included in the study. The mean age of the patients was 36.52 ± 15.24 . Majority of the patients were male. Twenty seven (54%) patients were operated on left side and twenty three (46%) patients were operated on right side. Average time interval between injury and date of surgery was 8.26 days and average time of operation was 95 minute.

Surgical technique: Under spinal anesthesia patient were placed in fracture table in supine position. The fractured limb was kept in traction and in adducted position. Unaffected limb was abducted. The fracture site was checked by C-Arm. The entry point site was incised and awl was introduced under C-arm guidance. The proximal end of the Femur was reamed and after Reduction within the reamer guide wire was passed to the distal part, Whole Femur was reamed then the Nail was inserted and locked with screw.



A. Position of the Patient



B. Instrument



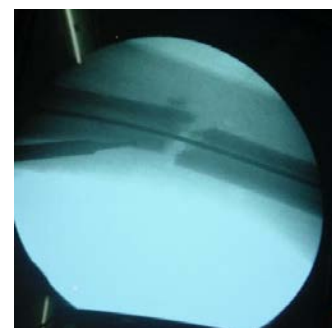
C. Incision



D. Insertion of awl



E. Insertion of guide wire



F. Reaming



G. Insertion of distal screw



H. Insertion of proximal screw

Hypothesis:

Treatment of adult closed fracture shaft of the femur by closed intramedullary interlocking nail is a satisfactory form of treatment.

Objectives

General Objective:

Evaluation of the results of closed intramedullary interlocking nail in closed fracture shaft of the femur.

Specific Objective:

- To determine fracture healing (Union, delayed union and nonunion).
- To reveal postoperative infection.

- To find out pain on weight bearing.
- To evaluate final range of motion of hip and knee joint.
- To assess any post-operative malalignment (Varus, valgus, rotation and shortening of the femur)

Study Variables

A. Demographic variables: age, sex

B. Clinical variables

(1) Side of involvement (2) Mechanism of injury (3) Time interval between arrival of hospital and fixation of fracture.

C. Postoperative follow up variables

(1) Fracture healing: a. Union b. Delayed union c. Non union

(2) Postoperative complications: Pain, Implant failure, Infection, and malalignment (varus, valgus, rotation and shortening of femur)

(3) Range of hip and knee movement.

Data Analysis: Data were collected, compiled and tabulated according to key variables. Data were analyzed using SPSS.

Table-I: Classification system of the results of treatment (Thorsten et al. 1985)

	Result			
	Excellent	Good	Fair	Poor
Malalignment of femur (degrees)				
Varus or valgus	5 ⁰	5 ⁰	10 ⁰	>10 ⁰
Internal rotation	5 ⁰	>10 ⁰	15 ⁰	>15 ⁰
External rotation	10 ⁰	15 ⁰	20 ⁰	20 ⁰
Shortening of femur (cm)	1	2	3	>3
Range of motion of knee (degrees)				
Flexion	>120 ⁰	>120 ⁰	90 ⁰	<90 ⁰
Extension deficit	5 ⁰	10 ⁰	15 ⁰	>15 ⁰
Pain or swelling	None	Sporadicminor	Significant	Severe

Results

During the period from September 2013 to August 2017, a total number of 50 patients were studied. All the patients were resuscitated, properly investigated, treated with closed interlocking intramedullary nail and followed up.

In this study, there were 50 patients with age range 18-65 yrs. Mean age was 36.52.

Table- II: Age distribution of the patients

Age	No.	Percentage
18-34 yrs	28	56
35-50 yrs	11	22
51-65 yrs	11	22
Total	50	100
Mean \pm SD	36.52 \pm 15.24	

Sex distribution:

In total 50 cases 86% were males and 14% were females.

Mechanism of injury:

In most cases, mechanism of injury mostly road traffic accident which was 78%.

Side of injury:

Among the 50 cases 23 cases (46%) were right sided fracture shaft of femur and 27 cases (54%) left sided fracture.

Table III: Distribution of the study subjects by their side of injury

Side of injury	No.	Percentage
Right	23	46
Left	27	54
Total	50	100

Types of fracture (Winqvist Hansen Classification)

Total number of patients were 50, among them 38 patients (76%) had Winqvist type I fractures, 05 patients (10%) had type II, 04 patients (8%) type III fracture and 3 patient (6%) had type IV fracture.

Table IV: Distribution of the study subjects by Winqvist Hansen Classification

Winqvist Hansen Classification	No. of patients with percentage	
	No.	Percentage
I	38	76
II	5	10
III	4	8
IV	3	6

Time interval between injury and operation: Average time interval between injury and operation were 8.26 ± 3.17 days.

Operation time: Average times required for operation were 95 minutes.

Dynamization: Dynamization required for 06 cases (12%).

Infection: There was no superficial or deep infection in this study

Pain: No pain observed in 46 cases (92%) but mild pain observed in 3 cases (6%)



Fig: Pie chart showing

Mal-alignment of the femur:

Table V: Distribution of the patients by postoperative mal-alignment of the femur

Mal-alignment of the femur	Experimental group (n=49)	
	No.	Percentage
Varus (Degree)	<5	2 / 4
	>5	0 / 0
	>10	0 / 0
Valgus (Degree)	<5	2 / 4
	>5	0 / 0
	>10	0 / 0
Shortening (cm)	1	3 / 6
	2	0 / 0
	3	0 / 0
External rotation 10^0	2	4
Internal rotation 5^0	1	2

- Implant failure: No cases of implant failure detected during the study period.
- Range of hip motion: All patients obtained full range of hip motion.
- Range of knee motion: 46 cases (92%) found full range of knee motion ($>130^{\circ}$), 2 cases (4%) found 120° .

Table VI: Distribution of the patients by postoperative range of knee motion

Knee motion (Degree)	Total number of patient (n=49)	
	No.	Percentage
130-140	46	92
120	2	4
100	0	0
90	0	0
<90	0	0

Fracture union: Among 49 patients 42 patients (84%) found full union, 6 patients (12%) found delayed union.

Table VII: Distribution of the patients by fracture union

Fracture Union	Total patient in percentage (n=49)	
	No.	Percentage
Union	42	84
Average time	20 weeks	
Delayed union	6	12
Non-union	0	0

Final clinical outcome: Excellent result found in 42 cases (84%). Good result found in 06 cases (12%)

Table VIII: Final outcome

Fracture Union	Total number of patients (n=49)	
	No.	Percentage
Excellent	42	84
Good	6	12
Fair	0	0
Poor	0	0

Complications:

During operation, one patient developed trochanteric fracture while reaming. Death of one patient was noted at 16th postoperative day at home possibly due to myocardial infarction.

Discussion

This study was carried out to evaluate the results of closed antegrade intramedullary interlocking nail for closed fracture proximal and mid shaft of the femur in adult. In this study sample size was 50.

In this study, fracture shaft of the femur was most common in younger people with mean age of 36.52, ranging from 18 to 65 yrs. Winquist et al¹⁰ in his series reported fracture shaft of femur common in adult with mean age 29.5 years age group. Braten M. et al¹¹ observed mean age of 29 years, which are near similar with this study.

Males were predominantly prone to fracture shaft of the femur due to high incidence found in motor vehicular accidents (86%), in this study males were predominant. Wiss DA et al¹² found male predominance (83.7%) in his 111 patient's series which is almost similar with the present study.

In this study had vehicular accident as the main cause of fracture of femoral shaft i.e. 78 % (39 patients), Winquist et al¹⁰ also had 77% of cases because of motor vehicular accidents. This observation by various authors implies that fracture shaft femur is usually a result of high energy trauma.

42 patients in this study achieved union. The average time for healing of the fracture was 20 weeks. Winquist et al, had union rate of 99.1%, Kempf et al¹³ showed 19 weeks of healing time in closed method. Result of healing time almost similar with previous study.

In this study, dynamization was done within ten to twelve weeks in 6 cases (12%). Papakostidis C. et al¹⁴ performed dynamisation within 10-12 weeks after static IM interlocking nail of fracture shaft of femur which almost similar with the present study.

Interval between injury and surgery in this study were 8.3 days. Hanks et al¹⁵ reported it as 7.4 days. In a study Rokkanen P. et al¹⁶ reported no appreciable difference in the results after early

(within one week) compared with those operated upon during the second and third weeks.

Average operative time in this study was 95 minutes. Lhowe WD et al¹⁷ in his series reported mean operative time of 182 min in 67 patients. Wiss DA et al¹² had average time for static locking 3 hr 15 min in his 111 cases. Our study required less operative compared other study.

In this study varus malunion found 2 cases (4%). Valgus mal union found 2 cases (4%). Antecurvatum found 2 cases (4%) and recurvatum found 2 cases (4%). William M.R.¹⁸ reported antecurvatum/recurvatum more in closed method due to supine position of the patient. External rotation <100 found in 4 cases (8%) and internal rotation deformity <50 found in 1 case (2%).

Excellent range of knee movement seen in 20 cases (40%), Good range of knee movement found in 10 cases (20%), Fair range of knee movement found in 10 cases (20%), poor range of knee movement found in 9 cases (18%).

Conclusion and Recommendations

In the light of the findings of the study, it can be concluded that closed locking intramedullary nailing for proximal and mid shaft femoral fracture is good treatment option because the duration of union was shorter, less infection, less blood loss, less scar formation, no disturbance of fracture haematoma, less postoperative pain and good range of knee motion. There is a chance of mal-alignment of fractures in closed method. Thus in closed method attention should be paid to mal alignment while locking the nail.

We recognize that this study has several limitations. These include small number of sample size and a short follow-up period. So, further prospective study with larger sample and longer follow-up period is recommended.

References

1. Zirkle LG Jr. Clin Orthop Relat Res. 2008 Injuries in developing countries—how can we help? The role of orthopaedic surgeons. *Clinical Orthopaedics and Related Research* 1985; 466(10): 2443-2450
2. Beveridge, M. Howard, A. The burden of orthopaedic disease in developing countries. *Journal of Bone Joint SurgAm.* 2004; 86: 1819-1822.
3. Mock, C. Cherian, MN. The global burden of musculoskeletal injuries: challenges and solutions. *ClinOrthopRelat Res.* 2008; 466: 2306-2316.
4. Ikpeme, I. et al. External jig-aided intramedullary interlocking nailing of diaphyseal fractures: experience from a tropical developing centre. *IntOrthop.* 2011; 35: 107-111.
5. Gosselin, R. Lavaly, D. Perkins traction for adult femoral shaft fractures: a report on 53 patients in Sierra Leone. *IntOrthop.* 2007; 31: 697-702.
6. Kuntscher, G. The intramedullary nailing of fractures. *Clin orthop.* 1968; 47: 809-818.
7. Ali, MA. Hussain, SA. Khan, MS. Evaluation of results of interlocking nails in femur fractures due to high velocity gunshot injuries. *J Ayub Med Coll Abbottabad.* 2008; 20: 16-19.
8. Malik, MH. Factors affecting rates of infection and nonunion in intramedullary nailing. *J Bone Joint Surg.* 2004; 86: 556-560.
9. Guodong, W. et al. A new intramedullary nailing device for the treatment of femoral shaft fractures: A biomechanical study. *Clinical Biomechanics.* 2008; 23: 305–312.
10. Winquist, R.A. Hansen, Jr. S.T. Clawson, D.K. Closed intramedullary nailing of femoral fractures. A report of five hundred and twenty cases. *J. Bone Joint Surg.* 1984; 66Am (4): 529-539.
11. Braten, M. Terjesen, T. Rossvoll I. Femoral shaft fractures treated by intramedullary nailing. A follow-up study focusing on problems related to the method. 1995; 26(6): 379-383.
12. Wiss, D.A. Fleming, C.H., Matta, J.M. Comminuted and rotationally unstable fractures of the femur treated with an interlocking nail. *Clinical Orthopaedics & Related Research.* 1986; 212: 35-47.
13. Kempf, I. Grosse, A. Beck, G. Closed locked intramedullary nailing: Its application to comminuted fractures of the femur. *J Bones & Joint Surg.* 1985; 67 (5) .p. 709-720.
14. Papakostidis, C. et al. Femoral-shaft fractures and nonunions treated with intramedullary nails: The role of dynamisation. *Injury.* 2011; 42: 1353-1361
15. Hanks, G.A. Foster, W.C. Cordea, J.A. Treatment of femoral shaft fractures with the Brooker Willis interlocking intramedullary nail. *Clinical Orthopaedics & Related Research.* 1988; 226: 206-218.
16. Rokkanen, P. Slatis. Vankka, P. Closed or open intramedullary nailing of femoral shaft fractures: A comparison with conservatively treated cases. *The journal of bone and joint surgery.* 1969; 51(2): 313-322.
17. Lhowe, D. W. Immediate nailing of open fracture of the femoral shaft. *JBJSurg.* 1988; 70(A). 812-820.
18. William, M.R. Femur: Trauma in Orthopaedic knowledge update home study syllabus, 8th ed. Alexander R.V. AAOS. 2005; p 427.

All correspondence to
Dr. Md. Habibul Hasan
 Junior Consultant
 Department of Orthopaedic Surgery
 Rajshahi Medical College Hospital
 Email: habibulhasan0706@gmail.com